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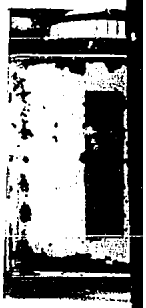

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SOURCE Report by Russian engineer employed at Plant imeni Petrovskiy until early 1949,

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DESCRIPTION OF METALLURGICAL PLANT IMENI PETROVSKIY

General Description

At the time of the revolution and up to the First Five-Year Plan, the Metallurgical Plant imeni Petrovskiy in Dnepropetrovsk produced at least 10 percent of all the metal smelted in the USSR. The plant, which was built in 1886 - 1887, is located in the northwest industrial sector of the city, at Goryainovo Station on the Stalin Railroad System. The plant faces on the railroad, and the tracks running north and south alongside the plant branch off from the main line to the "Kaydaki" and "Fabrika" industrial districts. Freight from the plant is hauled along these tracks to the Dnepropetrovsk Freight Station and to the left bank of the Dnepr. Goryainovo Station operates almost exclusively for three plants -- the Plant imeni Petrovskiy, the Plant imeni Lenin, and the Plant imeni Molotov, formerly a part of the Petrovskiy Plant.

Since the plant is situated in an extremely compact area, further expansion is impossible. The area is arranged in three terraces which slope down to the Dnepr. The plant administration and all production shops, with the exception of blast-furnace shop, are situated on the lowest and main terrace. The blast-furnace shop is on the next terrace, which is the smallest in size. Power installations and the marshaling station occupy the highest terrace.

The plant has a complete metallurgical cycle and includes the following main shops:

Blast-furnace shop with five furnaces having a total 24-hour productivity over 2,000 tons

Three open-hearth shops with ten furnaces having a total 24-hour productivity of not more than 1,500 tons

Bessemer shop with three acid converters having a total 24-hour productivity up to 1,300 tons

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Rail mill which produces girders and rails from Bessemer steel

Sheet-rolling and section-rolling shops with large-section, small-section, and wire-rolling mills

Special machine shop, the production of which is secret (prior to World War II it machined artillery shells)

Production-training combine with highly developed foundry production

Electric power plant with an operating capacity of 12,000 kilowatts, far below the power needs of the enterprise

Large consumers' goods shop with its own rolling installations

A number of service shops and installations, including a refractory and slag-cement shop, machine shop, construction and repair, forge and press, molding, and autogenous-welding shops, gas-driven blower, electric subplant (by which the plant is connected with the Dnepr Power System), compressor station, water supply installations (water for industrial purposes is supplied from a water tower on the grounds of the Plant imeni Molotov and drinking water from the city water main), etc.

The plant's basic equipment was installed before the revolution; by the time World War II started, it had become completely obsolete. Nevertheless, when the Germans advanced, this basic equipment was dismantled and shipped to the Urals, where the workers and engineering personnel were also sent. The remaining steel structures, crane equipment, and blast furnaces were blown up. During the occupation, the Germans attempted to operate the least-damaged open-hearth furnaces, but with no success. They inflicted further damage on the plant when they retreated, but the extent of the damage was apparently not too great.

Reconstruction of the plant began as soon as Soviet power was re-established in the Ukraine, i.e., in 1944, and is still going on. It is being carried out entirely on the basis of former equipment. Auxiliary equipment and structures have for the most part been modernized. The capacity of individual machines was increased only where the nature of the foundation made it possible. The dimensions of the furnaces were increased in terms of prewar parameters.

Present productivity is probably 60-80 percent of prewar, which can be partially explained by the decided improvement in the past 2 years in the technical and economic performances of the blast furnaces, open-hearth furnaces, and sheet-rolling mills.

The number of workers is estimated at approximately 20,000, and there are in addition at least 2,000 engineers, technicians, and service personnel. The administrative personnel is made up mostly of specialists who worked there before World War II. They include Korobov, plant director, Zhdanovskiy, chief of the blast-furnace shop, Novikov, chief of open-hearth shop No 1, and Malyy, chief of the sheet-rolling shop.

Blast-Furnace Shop

This shop has blast furnaces No 1, 2, 4, 5, and 6. Furnace No 3 was removed when the plant was expanded in the 1920s. All the furnaces are situated in one row on the second level of the plant area and extend more or less from east to west. The main ore yard is south of furnaces No 1, 2, 5, and 6 and has a number of bridges (forming two or three rows along the shop), with an inclined bridge to the first terrace where the marshaling tracks and the blower station for the shop are located.

As far as is known, blast-furnace dimensions are as follows:

Furnace No 1 -- hearth diameter 4,100 millimeters, capacity 371 cubic meters

Furnace No 2 -- hearth diameter 4,650 millimeters, diameter of widest part (raspar), 6,520 millimeters, throat 4,280 millimeters; hearth height 3,300 millimeters, bosh height 4,400 millimeters, height of "raspar" 1,740 millimeters, stack height 14,260 millimeters, total useful height 24,580 millimeters, and capacity 450-500 cubic meters

Furnaces No 4 and 6 (same dimensions) -- hearth diameter 5,500 millimeters, capacity 500 cubic meters

Furnace No 5 -- hearth diameter 5,300 millimeters, capacity 500 cubic meters

All furnaces have 12 tuyeres. The furnaces have a type of charge hoist devised by Gogotskiy, former director of the plant. The charge is put into a round bucket which proceeds to the inclined furnace bridge along an underground suspension track.

Prewar capacity of the shop was 2,000-2,500 tons of converter pig per 24 hours, with a top coefficient for capacity utilization of the furnace of 1.05 during the first half of 1940. During the first half of 1936, the coefficient was 1.0, as compared with a maximum of 0.90.

The furnaces had poor performance records while the plant was undergoing reconstruction in 1945 - 1946, and not until 1948 did their performance show marked improvement. In January 1948, the coefficient was 1.03, as compared with the planned 1.10, and later was 0.99. It is not known whether furnaces No 4 and 5 are now in operation, but it is reported that four of the five furnaces in operation before the war are now working.

Before the war, the plant smelted 700,000-800,000 tons of pig iron a year. Its present capacity can be estimated at approximately 500,000-650,000 tons.

The blast-furnace shop operates exclusively on Krivoy Rog ore, using the best low-phosphorus ore for smelting Bessemer pig. The plant's present coke requirements are met by coke from the restored Coke-Chemical Plant imeni Kalinin, which is adjacent to the Dnepropetrovsk Industrial Junction and is 2 kilometers southwest of the Plant imeni Petrovskiy. Limestone is obtained mainly from Pyatikhatskiy Rayon, although some is obtained from the Yelenovka Quarries in the Donbass.

The shop smelts converter pig (open-hearth and Bessemer), foundry pig, and ferro-manganese. When a furnace is near the end of a run, ferrosilicon with a silicon content of 10-12 percent, is smelted.

The shop has nearly 3,000 workers. In 1946 - 1947, Zhdanovskiy, an old worker at the plant, was shop chief, and it is quite probable that he still retains this position.

Open-Hearth Shop No 1

Open-hearth shop No 1 is situated in a compact and antiquated building, with no possibility either for further expansion of the shop or for increase in tonnage of the furnaces. There are four stationary furnaces with basic hearths. Hearth dimensions are as follows: No 1, 25.2 square meters; No 2, 24.4; No 3, 24.4; and No 4, 38.0. The approximate weight of the charge for furnaces No 1 - 3 is 45-55 tons and for No 4, 65-70 tons. The furnaces operate on the scrap process with 70-75 percent pig iron in the charge.

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The furnaces are heated by a mixture of generator, blast-furnace, and coke gas. On all furnaces, the gas and air ports are set on two levels, while furnace No 4 has gas and air ports built on the Venturi principle. Reinforcement on all furnaces is water cooled. Prior to the war, the ends of the gas ports were cooled in furnace No 2, while in No 3 the flame ports were cooled. As for control and measuring apparatus, the shop used meters for registering gas consumption and indicators for reversal of the valves.

The steel is cast in a casting pit and drawn off from the bottom of the ladle. The furnaces are operated an average of 200-250 melts between repair, and rarely, as many as 300-350. Before the war, the production of steel per square meter of furnace hearth was 3.8-4.0 tons per 24 hours, making a 24-hour productivity of 425-450 tons for the shop. The yearly operation of the furnace (rated time) amounted to 290-320 days (24-hour periods). The yearly steel output for the shop was 120,000-150,000 tons. The shop supplies ingots to the sheet-rolling shop located next to it.

Shop No 1 was the least damaged of all the steel-smelting shops in the plant. During the German occupation, furnace No 4 and the gas generators were restored. With the beginning of reconstruction in 1945, one of the first units to be put into operation was this same furnace, No 4. At first it operated at a lower optimum productivity than before the war (3.0-3.5 tons per square meter of hearth). By August 1947, when all the furnaces were back in operation, productivity amounted to 4.39 tons, as compared with the planned 3.98 tons and the prewar 4.03 tons per square meter. In 1948, productivity reached 4.6 tons per square meter and the shop began to produce nearly 12,000 ingots a month.

The shop has 300-400 workers. Novikov was shop chief in 1947 - 1948, as he was prior to the war.

Open-Hearth Shop No 2

This shop is somewhat newer in design than Shop No 1, but since it was constructed in the 1890s there are no actual differences in content or layout of equipment.

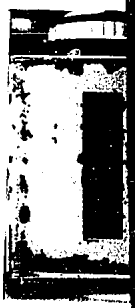
The shop has four stationary basic open-hearth furnaces (No 5 - 8) with the following hearth dimensions: No 5, 34.2 square meters; No 6, 33.0; No 7, 34.4; and No 8, 38.0. The furnaces use a charge of 60-70 tons on the molten pig, scrap, and ore process. The pig iron content in the charge is 80 percent. The pig is brought into the shop (as in the other open-hearth shops in the plant) directly from the blast-furnace shop, thus eliminating the use of the mixer, which is used exclusively for Bessemer pig.

The furnaces are heated by a mixture of generator, blast-furnace, and coke gas. The furnaces (as in Shop No 1) have the Ortovskiy roof lined with three 380-millimeter layers of brick and a fourth (on the Ortovskiy principle) of 450 millimeters. The steel is cast in the casting pit. The ladles are transported by bridge pouring cranes. The shop primarily casts lightweight ingots weighing 200 kilograms or more.

The production performance of this shop is essentially the same as that of Shop No 1, but since the total area of the furnace hearths in Shop No 2 is 139.6 square meters, as against 112.0 square meters in Shop No 1, the yearly output of steel is 25 percent greater and totals 150,000-200,000 tons. This shop has 400 to 500 workers.

Open-Hearth Shop No 3

Shop No 3 is located in the western part of the third terrace, near the chemistry laboratory and the plant administration building. The shop, modeled on the German type, was built in the 1920s, has bridge charging machinery, and its casting is done in a casting pit. The shop building is high and is well suited to all the requirements of contemporary open-hearth technology.



The shop has two furnaces, No 9 and 10. The steel framework of furnace No 9 was transferred from the Dnepropetrovsk Metallurgical Equipment Plant, where in 1916 an open-hearth furnace with a capacity of 60 tons was erected and then dismantled before completion.

The two furnaces have similar dimensions, each with a hearth area of 48 square meters. The rated charge at present is 100-120 tons, while the prewar charge was 140-170 tons. The furnaces are stationary, having gas and air ports built on the Venturi principle, with intensive cooling of the ports, embrasures, and port coverings (okonnaya kryshka).

A gas-generator station, equipped with Morgan generators (semimechanized) was installed for heating at the time the furnaces were erected. In the 1930s, gas mains for coke and blast-furnace gas were added. In the year before the war, the furnaces operated almost exclusively on a mixture of blast-furnace and coke gas. The furnaces are equipped with apparatus for controlling and regulating the flow of gas and air and for measuring the heating of the gas and air in the regenerators. The furnaces operated on the ore process, using molten pig, with 80 percent of pig in the charge. The steel is poured through a double spout into two ladles. Almost all the steel is teemed from the bottom of the ladles. Extremely light ingots -- up to 160 kilograms -- are cast, and there are 48 ingot molds on the bottom plate.

Before the war, and probably now, the shop produced, in addition to carbon steel for the plant's small-section and wire mills, a special steel which was a low-alloy silicon and medium manganese steel for bridge structures. These steels were also produced for the Plant imeni Molotov.

The shop's yearly productivity can be estimated at approximately 120,000-160,000 tons of steel, while the recovery per square meter of furnace hearth is between 5.0-6.0 tons.

The shop was demolished when the Red Army retreated, the cranes were dismantled, and the basic equipment was shipped away. Reconstruction began in 1946, and in 1947 operations of furnace No 10 were almost back to normal. At present, reconstruction can be said to be completely finished. Nearly 300 workers are employed in the shop.

Bessemer Shop

This shop is on the third and largest terrace, where all the converter shops are located. The shop is situated in the eastern part of the plant, adjacent to the rail shop.

The shop's converters use pig brought in ladles directly from the blast-furnace shop and also pig from the mixer, which is located in a separate building halfway between the blast-furnace and Bessemer shops. The mixer's capacity is 100 to 150 tons of pig. The mixer cannot be heated.

The Bessemer shop, built in the 1890s, is housed in a light building, the walls of which are lined with corrugated iron. The shop has three converters, each of which formerly used a 10-ton-charge capacity. The Bessemer shop was connected with the rail shop, which it supplied with ingots to be rolled into railroad and streetcar rails or into beams. After 1931, the converters used a 13-ton charge. The planned capacity of each converter was estimated at 9 tons. The bottom of the converter had seven tuyeres, each with eight 16-millimeter nozzles. In 1940, a blow with 10.5 tons of pig iron lasted 10-15 minutes, while the maximum blow was 18 minutes and the minimum 9 minutes. Steel was kept in the ladle for one to 3 minutes. The average time for one complete melt was nearly 25 minutes. Since the shop was put into operation again only in 1948, it is too early to estimate its present productivity. Before the war, the daily (24-hour) productivity of the shop was more than 1,000 tons of steel, while the yearly output was 300,000-350,000 tons and as high as 495,000 tons (estimated).

Prior to the war, the durability of the brickwork of the converter was 600 blows, each run between repairs lasting for 100-150 blows. The lining was replaced in 2-3 days (24 hour) and the bottom in 1-1½ hours, with a minimum of 20 minutes. The shop underwent annual capital repair, lasting from 15 to 20 days.

The steel is poured into ladles on ladle cars and is cast in the casting pit. The ingots ranged from 1½ to 3 tons, and six to ten ingots were cast from each melt. It was first planned to restore the shop in 1946. Evidently it was not put into operation until 1948, since the rail mill was not ready for operation until then, and without it there was no point in beginning Bessemer operations.

Before the war, the shop had nearly 250 workers, but the staff must be estimated at a somewhat lower figure now.

Rail Shop

The plant's rail shop was constructed in the late 1890s, at the same time as the Bessemer shop. It is housed in a frame building lined on three sides with iron and open on the side of the Bessemer shop directly contiguous to it. The shop includes a blooming mill which supplies billets to the "800" rolling mill. The blooming mill is a two-high reversing mill with rollers 1,100 millimeters in diameter and 3,000 millimeters long. The mill is powered by a steam engine with nearly 3,500-horsepower capacity. Ingots from 1½ to 2 tons and from 3 to 4 tons are rolled in the blooming mill.

The "800" rolling mill is equipped to roll type II-a and III-a rails, No 22, 24, 26, 28, 30, and 32 beams, and No 22, 24, 26, and 28 girders, from both Bessemer and open-hearth steel. The shop has both soaking pits and heatable soaking furnaces. Before the war, the productivity of the blooming mill was approximately 500-600 tons per 8-hour shift. The maximum capacity of the rail mill was 50-60 tons per hour and not more than 300-400 tons per shift. According to plan, the blooming and rail mills should have been put back into operation in 1948, but restoration was still not complete in the second half of 1948. There is insufficient data to determine how much remains to be completed. It must be assumed that by now both mills have already been put back into operation.

Sheet-Rolling Shop

This shop has a heavy-sheet mill, medium-sheet mill, and thin-sheet mills (No 4 and 10). The shop gets its ingots primarily from open-hearth shop No 1, situated only a short distance from it. All the sheet mills are German designed, with relatively low productivity, and were installed before the revolution. Productivity of the mills is as follows:

Heavy-sheet mill -- three-high, with rollers approximately 800, 650, and 800 millimeters in diameter; productivity per shift (8 hours) is 200-300 tons of rolled sheet

Medium-sheet mill -- three-high, with rollers 700, 500, and 700 millimeters in diameter; shift productivity is 50-65 tons

Thin-sheet mill No 10 -- two-high, with rollers 600 and 800 millimeters in diameter; maximum prewar hourly productivity was 4.66 tons and daily (24 hour) productivity 50-60 tons; first rolling mill in the plant to be put back into operation after reconstruction and with excellent results; stakhanovite records since reconstruction have been as high as 40 tons of finished product in a 7-hour shift, as compared with the shift norm of 18 tons (equal to prewar).

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Before the war, the sheet-rolling shop produced up to 150,000 tons of sheet a year. It must be assumed that the prewar level will be regained during 1949.

Section-Rolling Shops

The iron-rolling shop has a "560" medium- and large-section rolling mill installed in 1890, while the motor, which operated up to the war, was installed in 1910. This shop is nearly 80 meters long and 30 meters wide and is housed in a rather low, compact building.

The "560" mill extends in one line and has three-high stands designed on the Kleyn system and one two-high stand. The first three-high stand is a roughing stand with a roller table in front and an elevating, oscillating roller table to the rear. The second and third three-high stands are both roughing lines and finishing lines, depending on the section being rolled. These stands have pull-overs (two rollways forward and three to the rear).

The two-high stand is the finishing stand, and the majority of sections receive their last pass through this stand. At the end of the stand is an out-going table leading to the hot cutting saw.

The mill has a continuous two-row soaking furnace, 19 meters long and 4.6 meters wide, which operates on coal with forced heating by an oil burner. The rolled products are cut by a vertical saw located 29.5 meters from the mill axis. The mill is powered by an induction, 3,000-volt, 1,200-horsepower electric motor of 235 amperes at 97 revolutions per minute. The motor operates parallelly with a 62-ton, 7½-meter-diameter flywheel. The mill rolls ingots weighing up to 350 kilograms and up to 1,200 millimeters long. The maximum section of the ingots is 200 x 300 millimeters. The mill rolls both ingots and blooms. The mill also rolls beams (No 10), angles (80 x 80 x 8 millimeters), mine rails weighing up to 14.78 kilograms per linear meter, and other rolled products with similar dimensions, and also billets 97 x 97 millimeters and 110 x 78 millimeters. The mill's maximum productivity per shift before the war was 150-175 tons. Present yearly productivity can be estimated at 60,000-90,000 tons.

The medium-section shop is a part of the iron-rolling shop and is located on a different level from the rest of the shop. The "640" roughing stand serves the "500" medium-section mill and is a three-high Kleyn stand. At the front of the stand (leading from the furnace) is an elevating roller table, and at the rear is another roller table. Two jointly operating, continuous furnaces with plungers have been installed for heating the ingots. The maximum section of the ingots is 225 x 225, at a weight of 400 kilograms. The mill rolls both cast ingots and blooms.

The mill is driven at 90-120 revolutions per minute by a compound DC, 540-horsepower, 500-volt electric motor made by the Siemens and Halske firm. A 35-ton, 3½-meter-diameter flywheel is attached to the crankshaft.

The finishing line of the mill has three three-high "500" stands of the Kleyn type. The line's rollers are powered by a DC, 1,000-horsepower, 500-volt electric motor at 100-180 revolutions per minute, with a 35-ton, 3½-meter-diameter flywheel on the crankshaft. A disc saw for hot cutting has been installed 33.0 meters from the axis of the finishing line.

The mill rolls medium profile iron such as 60 x 60 x 6-millimeter angles, No 8 beams, mine rails weighing 11.18 kilograms per linear meter, and 52-millimeter round iron. The mill's daily productivity is nearly 200 tons and its yearly productivity, 50,000-60,000 tons.

The small-section shop has a "320" mill, "250" mill, and a "300" wire-rolling mill. The 250-millimeter small-section mill rolls 150-to 200-kilogram ingots. Its products are round iron (11-14 millimeters in diameter) and square iron (up to 20 square millimeters). The mill is not mechanized and consists of a roughing and

finishing line operated by hand from the front and rear, and having a 1,000 horsepower motor. Productivity of the roughing mill was 12-15 tons per hot hour in prewar years. A finished shape was rolled in five passes. Yearly productivity of the "250" mill was approximately 35,000 tons.

The 320-millimeter mill rolls round iron, square iron, and rod iron. It handles square iron of over 20 square millimeters and round iron of from 17 to 22 millimeters in diameter. The mill's productivity can be estimated at approximately 40,000 tons a year.

The wire mill is of comparatively old design, without automatic guide rollers. In 1940, its hourly productivity was a maximum of 10 tons and its shift productivity 35 tons. Yearly output was 25,000-30,000 tons. The mill rolled nail and telegraph wire up to 5.5-6.5 millimeters in diameter. This mill was specialized for rolling telegraph wire, and the Plant imeni Petrovskiy was one of the largest producers of telegraph wire in the USSR. There is no postwar information on the operations of this mill. It is only known that it is back in operation.

Special Machine Shop

The special machine shop fulfilled only wartime orders, chiefly the machining of artillery shells. The type of equipment it has, however, enables it to do work of a somewhat varied nature. Its production has been kept strictly secret. It is housed in one of the most modern buildings in the plant and is now completely restored. It is 60-70 meters long and 25-30 meters wide and has the usual windows and skylights in the roof.

The shop's equipment consists of a machine-tool park including nearly 100 units. The park includes planing, slotting, drilling, milling and grinding machines, lathes and universal machine tools. Soviet machines make up approximately 60 percent of the park, the remainder being of foreign import obtained mainly in the 1930s and undoubtedly augmented by the German equipment brought in after the war. The shop operates, with rare exceptions, in three shifts and has at least 350 workers.

Production-Training Combine

This combine is associated with an FZO school of the Ministry of Labor Reserves. It was removed from the plant area in the 1930s, and is now located in the southeast part of the workers' settlement of the plants imeni Petrovskiy and imeni Lenin. It is housed in a three-story, sufficiently spacious building. In addition to classrooms, the combine has a machine shop with an electric welding department, a large foundry serving the plant's requirements, and a molding shop. The combine, as its name suggests, is both a school and a production enterprise. The training program includes the following:

Night Metallurgical Institute of the Plant imeni Petrovskiy

Two-year school for Foremen of Socialist Labor which trains foremen in blast-furnace production, steelworkers, and rolling-mill workers

One-year courses in the above-mentioned specialties

Half-year courses for electric welders, autogenous welders, crane operators, etc.

A number of offices of methodology in various branches of metallurgy and service professions.

According to the plan, the production combine produces spare parts for plant equipment and agricultural equipment and also consumers' goods, the latter done for profit, as far as is known. The combine uses metal wastes from the plant as

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its material. The work is done in two shifts. The total number of trainees is estimated at approximately 300, while the permanent staff (teachers, instructors, and service personnel) is at least 100 persons. /Seven diagrams which show the layout of the plant, its shops and equipment, and which accompany the original document, have not been reproduced here./

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